REMARKS

Claims 5-25 and 27-56 are pending in this application. By this Amendment, claims 11 and 32 are amended to further distinguish from the Yamakoshi and Koji references. Claim 13 is amended to further distinguish from the Yamakoshi reference. Claim 55 is amended to correct a typographical error. The specification is also amended to correct typographical errors. The Amendments are supported in the present specification at, for example, page 18, lines 14-16, page 27, lines 19-21, Fig. 3 and Fig. 20. No new matter is added.

In view of the foregoing amendments and the following remarks, reconsideration and allowance of claims 5-25 and 27-56 are respectfully requested.

35 U.S.C. §112 Rejection

Claim 20 was rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite. Applicants respectfully traverse this rejection.

The Patent Office alleges that the feature of claim 20 reciting "a capacitor that is located in proximity to an RF antenna and detects a voltage applied to the RF antenna" is allegedly not described in the specification. This is incorrect.

The specification describes, on page 28, lines 4-6, that a portion of the RF antenna 16 is projected to the outside of the vacuum chamber 11. The pick-up coil 44 and the capacitor 45 may be preferably located close to the projected portion (of the antenna) so that they may not be eroded by the plasma.

Thus, the specification clearly describes that a capacitor is located in proximity to an RF antenna.

Withdrawal of the rejection is respectfully requested.

35 U.S.C. §102(b) and §103(a) Rejection Relying On Yamakoshi

Claims 5-7, 11-14, 16, 18, 24-26* and 32-37 were rejected under 35 U.S.C. §102(b) as allegedly being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as allegedly being obvious over, Yamakoshi (U.S. Patent Application Publication No. 2001/0021422). Applicants respectfully traverse this rejection.

The Patent Office alleges that Yamakoshi describes all of the features of claims 5-7, 11-14, 16, 18, 24-25 and 32-37 except the length of a conductor. However, Yamakoshi does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claims 5-7, 11-14, 16, 18, 24-25 and 32-37 for at least the following reasons.

Claim 5

Claim 5 requires that a plate-shaped conductor is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber. This feature of claim 5 allows the heat generated by the RF antennas to be released outside of the vacuum chamber. In doing so, the stability of the impedance of the RF antennas is improved by alleviating an increase in the electric resistance that would otherwise occur with a rise in temperature of the antenna conductor at the connection point when electrical power is supplied thereto. Yamakoshi does not describe, in any way, at least this feature of claim 5.

Yamakoshi describes a discharge plasma generating method including opposing a discharge electrode that has a substantially planar discharge portion to a substrate to be processed in a vacuum reaction vessel wherein the discharge electrode and the substrate are substantially parallel to each other and evacuating the vacuum reaction vessel and supplying a process gas to a space between the discharge electrode and the substrate. See the Abstract of

* Claim 26 was indicated as rejected in error. Claim 26 had been previously canceled and was not pending at the time of the current Office Action.

Yamakoshi. Yamakoshi further describes a ground electrode that includes a mechanism for holding a glass substrate, and a single ladder electrode that opposes the ground electrode with 20 mm between them. See page 8, paragraph [0140] and Fig. 29 of Yamakoshi. The ladder electrode (alleged equivalent to the antennas of claim 5) of Yamakoshi is formed by assembling a plurality of parallel longitudinal rods and one or more pairs of parallel lateral rods into the form of a lattice. See paragraph [0141] and Fig. 8 of Yamakoshi.

However, Yamakoshi does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, a plate-shaped conductor that is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber, as required by claim 5.

Claims 11 and 32

Claims 11 and 32 require adjacent electrodes of one or more pairs of adjacent RF antennas to have the same polarity, and the multiple RF antennas are substantially U-shaped. The benefit of these features is that by having the same polarity among one or more pairs of the U-shaped RF antennas, an unintentional voltage between adjacent electrodes is avoided. An unintentional voltage may occur if the antennas have opposite polarities, and in turn, may cause the local plasma density to be locally high in the region having the unintentional voltage. See page 25, line 25 to page 26, line 9 and Fig. 17B of the present specification.

Yamakoshi does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, at least these features of claims 11 and 32.

Claims 13 and 34

Amended claim 13 and claim 34 require that an impedance element be connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, the impedance element of claims 13 and 34 can control multiple antennas individually. Yamakoshi

does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, this feature of claim 13 for at least the following reasons.

Yamakoshi describes a pair of impedance matching circuits 7a and 7b. The impedance matching circuits (IMC) match the impedances of a discharge electrode and the power supply. See paragraphs [0065], [0143] and Fig. 15 of Yamakoshi. The IMCs of Yamakoshi are connected to the whole of ladder electrodes 303, and are not individually connected to each of the ladder electrodes separately. Thus, Yamakoshi can not control multiple RF antennas individually.

For at least the foregoing reasons, Yamakoshi does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of amended claim 13 and claim 34.

Conclusion

For at least the foregoing reasons, Yamakoshi does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claims 5-7, 11-14, 16, 18, 24-25 and 32-37.

Withdrawal of the rejection is respectfully requested.

35 U.S.C. §103(a) Rejections

Masaji In View Of Koji

Claims 5-14, 16, 18, 23-26* and 29-56 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji (JP 2001-035697) in view of Koji (JP 2000-073174). Applicants respectfully traverse this rejection.

The Patent Office alleges that Masaji describes all of the features of claims 5-14, 16, 18, 23-25 and 29-56 except that each RF antenna is connected to a plate-shaped conductor.

* Claim 26 was indicated as rejected in error. Claim 26 had been previously canceled and was not pending at the time of the current Office Action.

However, Masaji and Koji do not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claims 5-14, 16, 18, 23-25 and 29-56 for at least the following reasons.

Claim 5

As described above, claim 5 requires that a plate-shaped conductor is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber. This feature of claim 5 allows the heat generated by the RF antennas to be released outside of the vacuum chamber. In doing so, the stability of the impedance of the RF antennas is improved by alleviating an increase in the electric resistance that would otherwise occur with a rise in temperature of the antenna conductor at the connection point when electrical power is supplied thereto. Neither Masaji nor Koji describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, at least this feature of claim 5.

Masaji describes an antenna installed inside a vacuum container for the purpose of plasma generation, a stage located inside the vacuum chamber, and multiple antennas attached to the sidewalls of the vacuum chamber and arranged parallel to the stage. See the Abstract and Drawings 1 and 11, of Masaji. Thus, Masaji does not describe a plate-shaped conductor is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber, as required by claim 5.

Koji describes that two or more conducting bars are connected between a metal frame of the high-tension side of a plasma CVD device for supplying electric power in high frequency power, and a metal frame of the earth (grounded) side. See the Abstract and paragraph [0019] of Koji. However, Koji does not describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, a plate-shaped conductor connected to multiple RF antennas in parallel and arranged outside a vacuum chamber, as required by claim 5. Thus, Koji does not remedy the deficiencies of Masaji.

For at least the foregoing reasons, neither Masaji nor Koji, alone or in combination, describe or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claim 5.

Claims 8 and 29

Claims 8 and 29 require multiple RF antennas arranged substantially parallel to a stage with the vacuum chamber, where an aspect ratio of the RF antenna at a position corresponding to a target area of the stage is set at a value that is determined according to a plasma density or plasma electron energy desired for the target area. The benefit of this feature is to allow the plasma electron energy or plasma density at specific areas in the vacuum chamber to be controlled. Neither Masaji nor Koji describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, at least this feature of claims 8 and 29.

The Patent Office alleges that this feature of claims 8 and 29 would have been obvious because Masaji discloses multiple antennas. However, the mere disclosure of multiple antennas does not, in itself, provide any reason or rationale for one to have adjusted the aspect ratio of the RF antennas to control plasma density or plasma energy in a desired region of a vacuum chamber.

Koji also does not provide any reason or rationale for one of ordinary skill in the art to have come to multiple RF antennas arranged substantially parallel to a stage with the vacuum chamber, where an aspect ratio of the RF antenna at a position corresponding to a target area of the stage is set at a value that is determined according to a plasma density or plasma electron energy desired for the target area, as required by claims 8 and 29. Thus, Koji does not remedy the deficiencies of Masaji in this regard.

Claims 11 and 32

Claims 11 and 32 require adjacent electrodes of one or more pairs of adjacent RF antennas to have the same polarity, and the multiple RF antennas are substantially U-shaped.

The benefit of these features is that by having the same polarity among one or more pairs of the U-shaped RF antennas, an unintentional voltage between adjacent electrodes is avoided. An unintentional voltage may occur if the antennas have opposite polarities, and thus may cause the local plasma density to be locally high in the region having the unintentional voltage. See page 25, line 25 to page 26, line 9 and Fig. 17B of the present specification.

Paragraph [0047] of Masaji specifically states that the RF antennas are in the shape of a ring. Thus, the RF antennas of Masaji are not substantially U-shaped.

Koji also does not describe, or provide any reason or rationale for one of ordinary skill in the art for one to have come to, a U-shaped antenna, as in claims 11 and 32. Thus, Koji does not remedy the deficiencies of Masaji in this regard.

Thus, neither Masaji nor Koji describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, at least this feature of claims 11 and 32.

Claims 13 and 34

Amended claim 13 and claim 34 require that an impedance element be connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, the impedance element of claims 13 and 34 can control multiple antennas individually.

Neither Masaji nor Koji describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, an impedance element being connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas, as required by claims 13 and 34.

Conclusion

For at least the foregoing reasons, Masaji and Koji, alone or in combination, do not describe or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claims 5-14, 16, 18, 23-25 and 29-56.

Withdrawal of the rejection is respectfully requested.

Masaji In View Of Minoru Kanda

Claims 15 and 16 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji in view of Minoru Kanda (JP 2002-260899). Applicants respectfully traverse this rejection.

The Patent Office alleges that Masaji describes all of the features of claims 15 and 16 except that each antenna is connected to a separate power supply. The Patent Office introduces Minoru Kanda to allegedly remedy the deficiencies of Masaji in this regard. However, for at least the following reasons, neither Masaji nor Minoru Kanda describe, or provide any reason or rationale for one of ordinary skill in the art to have come to, all of the features of claims 15 and 16.

Claims 15 and 16 are dependent on claim 13. Amended claim 13 requires that an impedance element being connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, the impedance element of claim 13 can control multiple antennas individually. As described above, Masaji does not describe this feature of amended claim 13.

Minoru Kanda also does not, in any way, describe this feature of claim 13. Minoru Kanda also does not provide any reason or rationale for one of ordinary skill in the art to have come to, an impedance element being connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, Minoru Kanda does not remedy the deficiencies of Masaji.

Withdrawal of the rejection is respectfully requested.

Masaji In View Of Choi

Claim 17 was rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji in view of Choi (U.S. Patent Application Publication No. 2002/0023718). Applicants respectfully traverse this rejection.

The Patent Office alleges that Masaji describes all of the features of claim 17 except that a variable impedance could be a variable inductance coil. The Patent Office introduces Choi as allegedly remedying this deficiency of Masaji. However, for at least the following reasons, Masaji and Choi, alone or in combination, do not render obvious all of the features of claim 17.

Claim 17 is dependent from claim 13. Amended claim 13 requires that an impedance element be connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, the impedance element of claim 13 can control multiple antennas individually. As described above, Masaji does not describe this feature of amended claim 13.

Choi also does not, in any way, describe this feature of claim 13. Choi also does not provide any reason or rationale for one of ordinary skill in the art to have come to, an impedance element being connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, Choi does not remedy the deficiencies of Masaji.

Withdrawal of the rejection is respectfully requested.

Masaji Or Yamakoshi In View Of Nakamura

Claims 19-21 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji or Yamakoshi in view of Nakamura (JP 2001-094485). Applicants respectfully traverse this rejection.

The Patent Office alleges that both Masaji and Yamakoshi describe all of the features of claims 19-21 except a pickup coil and a bridge rectifier with a capacitor to measure power. The Patent Office introduces Nakamura to allegedly remedy the deficiencies of Masaji and Yamakoshi. However, for at least the following reasons, none of Masaji, Yamakoshi or Nakamura, alone or in combination, render obvious all of the features of claims 19-21.

Claims 19-21 depend from claim 13. Amended claim 13 requires that an impedance element be connected to each of the RF antennas that regulates a current or voltage of each of

the RF antennas. Thus, the impedance element of claim 13 can control multiple antennas individually. Neither Masaji nor Yamakoshi describe this feature of amended claim 13.

Nakamura also does not describe, in any way, this feature of claim 13. Further Nakamura does not provide any reason or rationale for one of ordinary skill in the art to have come to, an impedance element being connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, Nakamura does not remedy the deficiencies of Masaji and Yamakoshi.

Withdrawal of the rejection is respectfully requested.

Masaji Or Yamakoshi In View Of Koji Oku

Claim 22 was rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji or Yamakoshi in view of Koji Oku (JP 08-162291). Applicants respectfully traverse this rejection.

The Patent Office alleges that both Masaji and Yamakoshi describe all of the features of claim 22 except a mixer for voltage and current signals to measure power. The Patent Office introduces Koji Oku to allegedly remedy the deficiencies of Masaji and Yamakoshi. However for at least the following reasons, none of Masaji, Yamakoshi or Koji Oku, alone or in combination, render obvious all of the features of claim 22.

Claim 22 depends from claim 13. Amended claim 13 requires that an impedance element be connected to each of the RF antennas that regulates a current or voltage of each of the RF antennas. Thus, the impedance element of claim 13 can control multiple antennas individually. Neither Masaji nor Yamakoshi describe this feature of amended claim 13.

Koji Oku also does not describe, in any way, this feature of claim 13. Further Koji Oku does not provide any reason or rationale for one of ordinary skill in the art to have come to, an impedance element being connected to each of the RF antennas that regulates a current or

voltage of each of the RF antennas. Thus, Koji Oku does not remedy the deficiencies of Masaji and Yamakoshi.

Withdrawal of the rejection is respectfully requested.

Masaji Or Yamakoshi In View Of Kojin Nakagawa

Claims 27 and 28 were rejected under 35 U.S.C. §103(a) as allegedly being obvious over Masaji or Yamakoshi in view of Kojin Nakagawa (JP 08-325759). Applicants respectfully traverse this rejection.

The Patent Office alleges that both Masaji and Yamakoshi describe all of the features of claims 27 and 28 except controlling plasma by regulating antenna length. The Patent Office introduces Kojin Nakagawa to allegedly remedy the deficiencies of Masaji and Yamakoshi. However, for at least the following reasons, none of Masaji, Yamakoshi or Kojin Nakagawa, alone or in combination, render obvious all of the features of claims 27 and 28.

Claim 27 requires that a plate-shaped conductor be connected to multiple RF antennas in parallel and arranged outside a vacuum chamber. This feature of claim 27 allows the heat generated by the RF antennas to be released outside of the vacuum chamber. In doing so, the stability of the impedance of the RF antennas is improved by alleviating the an increase in the electric resistance that would otherwise occur with a rise in temperature of the antenna conductor at the connection point when electrical power is supplied thereto. Neither Yamakoshi nor Masaji describe, in any way, at least this feature of claim 27.

Kojin Nakagawa describes that a distance between two optional points, at the farthest distance from each other, on a peripheral part of an electrode body facing the space that produces plasma, is controlled to be greater than or equal to one quarter of the wavelength of the high frequency power. See the Abstract of Kojin Nakagawa. However, Kojin Nakagawa does not describe, in any way, a plate-shaped conductor is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber as required by claim 27.

Further Kojin Nakagawa does not provide any reason or rationale for one of ordinary skill in the art to have come to a plate-shaped conductor that is connected to multiple RF antennas in parallel and arranged outside a vacuum chamber. Thus, Kojin Nakagawa does not remedy the deficiencies of Masaji and Yamakoshi.

Claim 28 is dependent from claim 27. For at least the respective dependency of claim 27, and for the additional features recited therein, claim 28 is not rendered obvious by any combination of Masaji, Yamakoshi and Kojin Nakagawa.

Withdrawal of the rejection is respectfully requested.

Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that this application is in condition for allowance. Favorable reconsideration and prompt allowance of claims 5-25 and 27-56 are earnestly solicited.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

James A. Oliff
Registration No. 27,075

Andrew B. Whitehead
Registration No. 61,989

JAO:ABW/tca

Date: December 22, 2008

OLIFF & BERRIDGE, PLC
P.O. Box 320850
Alexandria, Virginia 22320-4850
Telephone: (703) 836-6400

DEPOSIT ACCOUNT USE AUTHORIZATION
Please grant any extension necessary for entry;
Charge any fee due to our Deposit Account No. 15-0461